ENGINEERING LITERATURE

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Many engineers will doubtless wish to secure the monograph on "The Relation of Rainfall to Run-Off," by Mr. Geo. W. Rafter, M. Am. Soc. C. E., just published as Water Supply and Irrigation Paper, No. 80, by the U. S. Geological Survey. Lack of time prevents giving in our present issue the extended notice which this important publication deserves, and therefore especial prominence is given to an announcement that the paper is now available, on application, to the Director of the U. S. Geological Survey, Washington, D. C., or to members of Congress, but is likely to be speedily exhausted. A word to the wise should be sufficient.

If anything were needed to illustrate the extent to which the misuse of technical words becomes rooted and grounded in engineering literature, certainly no better example could be afforded than the repeated and exclusive substitution of watershed for drainage area or catchment area in the recent admirable report of the Commission on Additional Water Supply for New York City. Nothing could have been better calculated to lessen the vanity of an editor than to have the somewhat lengthy note on the misuse of watershed, in the September Supplement, followed so speedily by the repeated use of that word in so important an engineering report, by three of the most noted engineers of the country. But perhaps the report was written before the editorial note was published, or it may be that the note escaped the attention of such busy men as the authors of the report. Until something to the contrary is learned it may be assumed that one or the other of these assumptions is correct and that the circumstance related was merely a coincidence.

Meanwhile a fourth well-known engineer has raised an objection to the term "Census of Street Traffic." He urges that Travel should be substituted for Traffic, and that traffic means goods and merchandise, and should not be applied to the number of horses and vehicles used for their transportation. At first we were inclined to agree with him, but that inclination was changed after finding the following in two reliable American dictionaries:

FROM THE CENTURY DICTIONARY.

TRAFFIC.—1. An interchange of goods, etc., etc.

2. The coming and going of persons or the transportation of goods along a line of travel, as on a road, railway, canal, or steamship route. (Example): Traffic during that 36 hours was entirely suspended.—T. C. Crawford, "English Life."

Hence—3. The persons or goods collectively passed or carried along a route or routes.

TRAVEL.—6. The passage or concourse of travelers; persons traveling: as, the travel was very heavy on outgoing trains and boats.—[Colloq.]

FROM THE STANDARD DICTIONARY.

TRAFFIC.—The exchange of goods, etc., etc.

2. [Recent.] The business of transportation, as of persons, animals, or goods; as railroad or canal traffic.

3. [Recent.] The subjects of transportation collectively; the persons, animals or goods carried.

TRAVEL.—4. [Colloq.] The movement or concourse of travelers; as, the June travel to Europe.

The foregoing quotations show that street traffic may correctly be used to indicate either persons or goods passing along a street, and hence, by inference, to denote passing horses and vehicles. Both authorities class the use of travel, when applied to those traveling as colloquial.

New books, particularly those not of a popular character, generally come slowly from the press in summer time. During the past season, however, a goodly number of technical books were published, and already there are indications of the early appearance of many new books and new editions of importance. Of new or revised engineers' pocket-books, in particular, there are a plenty, as will be seen by readers of the Supplement for this month, and also for November. A gratifying feature of the last few years has been the large number of new and revised editions that have appeared. We have assurances that many more revisions will soon be ready. An important revision and enlargement already completed, but which cannot be given proper attention in this number, is "The Elasticity and Resistance of the Materials of Engineering," by Prof. Wm. H. Burr, of Columbia. Although so many revisions have been undertaken of late we could easily name a half-dozen or more books, once in the foremost rank of engineering literature, that are now sadly in need of revision. We shall not do so at present, but our columns are open for our readers to make known, if they see fit, what books, to their minds, stand most in need of revision or enlargement to bring them up to date.

As has often been stated in Engineering News and elsewhere, no technical book can be kept strictly up to date. In fact, it is true of nearly every engineering book published that an addition or revision is called for in the interval between proof-reading and binding on account of the announcement of some new discovery or development. The more ambitious the book the more likely is it that the foregoing statement will be applicable. The telegraph and the daily paper combine to present a vast mass of new technical information to a large and ever-increasing audience, but for the most part such information is in so crude a form as to be misleading, and, to all except a relatively few well-trained men, of little or no lasting benefit until it has been digested and after that correlated with existing digested information. Besides the crudity of the news of the day much that is essential to the technical man is never discovered by reporters and special correspondents and would not be adequately described if it were.

The function of the technical journal is to gather up, sift, weigh, digest and, so far as possible, correlate the new ideas, discoveries, and experiences with the information already collected and classified. By such means, and such alone, is it made possible for anyone to keep pace with modern developments.

The task outlined in the preceding paragraph has been taken up by Engineering News; and because this journal aims to cover so wide a field it is not possible to answer the following inquiry from a Canadian reader by naming only one British journal. Our correspondent writes:

Sir: Can you give me information, through your columns, concerning the names and addresses of engineering journals published in Great Britain, that takes the place, in that country, of Engineering News in the States.

Yours truly, Frank H. Gilbert.

Cardinal, Ont., Canada, Sept. 18, 1903.

It is, of course, true that "Engineering" and the "Engineer" (35 Bedford St., and 33 Norfolk St., London, W. C., respectively) are the leading engineering journals of Great Britain, and, to a lesser extent, of her colonies, but those two journals are devoted, first of all, to mechanical, military and naval engineering, and while they go quite extensively into certain branches of civil engineering, like bridge and railway construction, they publish comparatively little on the multifarious and important divisions of municipal engineering and sanitation. For the latter one must turn to "The Surveyor" (24 Bride Lane, Fleet St., London, E. C.) and "The Contract Journal" (139 Salisbury Court, London, E. C.). But the technical articles in the two last-named journals are mostly reprints of Society papers. All the foregoing are published weekly. The new "Public Works," the first number of which was noted in this Supplement for August 20, 1903, is issued monthly by the publishers of "The Surveyor." The two numbers thus far issued have covered a wide range of both topics and country, but they lack somewhat in technical detail, and contain little that can be called news.

The last statement leads us to remark, in closing this discussion, that a well-edited weekly technical journal can to a large extent combine the more solid news features of a daily with the accuracy and mature consideration of either a monthly or even the best of the few really good encyclopedias.

The Criticism of Technical Books.

It is extremely rare that a scientific book is the work of a single man; rarest of all in the case of engineering books. A book dealing with any branch or ramification of engineering work must be in the main a summary of the experiences and views of a great number of men. The more completely it represents those views and experiences, the greater is the value of the book, and the more truly is it a "storehouse of knowledge," a source of instruction for the young, and a manual of reference to the old engineer.

The mere writing of a book is, of course, usually the task of one man. But the actual writer's share in the production of the book is only that of collecting, averaging, and arranging the opinions and results of those who have labored in the field of which it treats. In addition it is also his province and duty to forecast, from the results of their compilation, the development of the immediate future; if in this work he is able to point the way to improvement, indicating for example how the results of the calculator and the work of the builder may be harmonized, he will have produced a book of maximum value. In appreciating this, however, we must not forget that the writer of the book is only one of its many authors.

Books of engineering, like all other things, are more or less imperfect, approaching perfection as a finite variable approaches its limit. As a matter of experience, errors may and do exist in books not only after the most careful proof-reading, but after revision and re-revision. Such errors may be mistakes of facts, or mistakes of opinion; they may even be mere errors of omission, there being no untruth or inaccuracy in the statements actually made. Whatever the nature of the errors, they will yet to some extent affect the precision of the teaching of the book, and for that reason should be discovered and corrected.

The correction of the errors or inaccuracies of engineering books is of much importance. Contemporary and succeeding generations may be misled by them if they are passed by and are allowed to stand in successive editions of a work. Usually, the writer of the book is sufficiently interested in his work to be continually on the lookout for errors, so that many or most of them are corrected in a second edition; though examples are

not wanting where gross mistakes have stood uncorrected through edition after edition. In any case, however, it is but natural to expect that not all of the errors will be corrected through his efforts alone, especially such errors as may involve his personal opinion or point of view. What is required to more rapidly and more completely locate the errors in any engineering book is the cooperation of all its authors. A more general and more conscientious criticism of books by their readers is needed.

We feel that this subject deserves closer attention than is accorded it by the majority of engineers. It is not the fashion among them to criticise publicly the books that are published for their use; that is left to the reviewers of books, the technical periodicals, to whom the books are sent for this purpose. No doubt every engineer who reads a work dealing with his special field makes definite mental criticism of all passages which seem to him incorrect or otherwise to merit disapproval. Many, indeed, make a regular practice of noting down all such criticisms, together with the corrections which seem suitable, either in the margin adjoining the passages in question or on separate correction slips; this is no doubt an excellent practice. But few engineers realize the importance of the matter sufficiently to make known their criticisms, bringing them to the attention of either the author or their professional colleagues.

We believe that the criticism of technical books should be considered as a duty which the engineer owes to his profession, and therefore also to himself. Certainly, whatever tends to increase the value of technical books by decreasing the errors which they contain works to the advantage of the individual engineer, who depends upon them for the largest part of his information. As has been indicated above, every engineer, broadly speaking, has a share in the authorship of all books in his special field of work which are published or revised during his engineering life; and if his views are misrepresented in any one of these books, or statements appear which he believes to be untrue, it is manifestly proper for him to record his disapproval or state his correction in such a manner that it may become known to others. The importance of this will be more apparent when it is reflected that a large part of engineering literature represents (or is intended to represent) an average of opinion or an average of current practice in regard to various matters of design or execution. It is not always easy for a single writer to determine such an average with accuracy; and where it is inaccurately determined and stated, the public criticism of many different engineers is the best if not the only way to fix the true average and thus to lead to the correction of the error.

The amount and kind of criticism possible in the book reviews of technical periodicals is quite limited. Not only is the reviewer's perusal of a book far different from the thorough study which is given to it by its purchaser and user, but it is also true that the reviewer, however capable, is but one, while the users of the book are many; and not every minor book can be reviewed by a specialist. It must be appreciated, too, that the primary function of the book review is a general weighing and valuing of the book and outlining of its scope and content. Criticism of details can take, therefore, only a subordinate place in the book review.

We may suggest that the Engineering Literature Supplement to Engineering News is a suitable place for criticisms of technical books on the part of our readers. We shall be glad to give space and prominence to correspondence of this kind.*

The preceding discussion has related almost wholly to errors of omission and commission. It may be added that broader criticisms are also welcome, and that true criticism includes approval as well as disapproval, and that it is most useful when it is constructive rather than destructive, and kindly rather than harsh and overbearing.

*It may be observed that correspondence need not be published over the author's signature, though it is essential that the name of the writer accompany his letter to us.

Steam Boilers.

Reviewed by Prof. Wm. Kent, M. Am. Soc. M. E.*

THE PRACTICAL PHYSICS OF THE MODERN STEAM BOILER.—By Frederick J. Rowan, Assoc. M. Inst. C. E. With a Preface by Prof. R. H. Thurston, Cornell University. New York: D. Van Nostrand Co. Cloth; 6×9 ins.; pp. xxxi. + 638; many tables; 314 illustrations in the text. $7.50.

The scope of this rather bulky volume is stated in the "Introductory Note" by Professor Thurston as follows:

> The book is not a systematic treatise covering the whole field of design, construction and operation of every class of boiler nor is it intended as such. It is a discussion of a defined and limited part of that great department of engineering, and its illustrations of fact and principle are very largely devoted to the modern types of water-tube boilers, while the purpose of its writer is declared to be quite as much the indication of the trend of improvement as the exhibition of their present status as apparatus for the evolution and storage of thermal energy.

The author's purpose is also shown by the following extracts from his preface:

> I have not thought it necessary or advisable to follow the well-beaten track, but have endeavored to take another path, as guided by the indications of physical research towards the goal of a fuller understanding of the actions involved in steam raising, and of the requirements of efficient boilers. . . . My aim is not so much to treat of how boilers are made as to consider on what lines they may be improved.

After a short introductory chapter, in which the author criticises a statement, published in another work, concerning the requirements of a good steam boiler, and substitutes ten criteria of his own, a chapter of 40 pages follows entitled: "Some Fundamental Elements of Boiler Design." The object of this chapter seems to be to prove, by lengthy quotations of the results of experiments, that the Scotch marine boiler is peculiarly liable to dangerous strains on account of its form, and that the Belleville water-tube boiler also is faulty in its design. This chapter concludes with five other criteria of good boilers, briefly and rather indefinitely stated. We quote one of these: "The form must be regulated by the requirements of the circulation of the water and of the heating medium."

The next chapter, of 60 pages, is devoted to "Combustion." This is an old and hackneyed subject, most clearly treated by dozens of writers, and it is not to be expected that Mr. Rowan can improve on what has already been written; but he embellishes it with his own particular style, of which the following is a sample:

> Unlike marsh-gas, acetylene is produced by reactions taking place at a high temperature, and this may account for its greater potential energy. One of the fundamental principles of thermo-chemistry is that the quantity of heat evolved is the measure of the sum of the chemical and physical work accomplished in the reaction. This supposes that all the actions taking place in the accomplishment of a given result are known, so that the elements of which that result is composed can be counted. When, for instance, solid bodies become by chemical union a gaseous compound, heat is absorbed or becomes latent, and a portion of this heat may become sensible during the transfer of one of these gaseous constituents to another combination.

Paragraphs like the above are found throughout the book, and they detract greatly from its usefulness. The statements made in this particular paragraph are vague, and if true are true only within limitations which are not stated. Thus, if C is turned to CO_2, generating 8,080 calories, we do not know that any heat becomes latent. The statements are also entirely unnecessary, as acetylene is not used as a fuel under steam boilers, and it has no relation to their "practical physics."

The author states that the "insufficiency of present methods" of determining the calorific value of fuel is shown by the results of the trials of Scheurer-Kestner and Mennier-Dollfus made under the auspices of the Industrial Society of Mulhouse, and that "in fact it may be taken as almost a general rule that higher heating effects may be obtained from fuel than a calculation of calorific power according to the usual methods would cause us to expect." He seems to be entirely unaware of the fact that the results of Scheurer-Kestner's work, made known as long ago as 1868, have been entirely discredited by the work of Mahler, in France, published in 1892, and by the more recent work of Bunte, in Germany, and of Lord and Haas, in the United States. Their results agree in showing that all the ordinary coals have almost exactly the heating value (when tested in an accurate calorimeter) which calculation from their composition by means of the old Dulong formula would lead us to expect.

On p. 62 we find it stated that 12.2 lbs. of air supplies (theoretically) the oxygen necessary to burn 1 lb. of carbon. Other writers give 11.52 lbs., which is correct according to the accepted figures of atomic weights of oxygen and carbon and the constitution of air.

The chapter on combustion contains descriptions of Howden's and other systems of heating air for burning coal under boilers, and tables of results of experiments made with them. Chap. IV., on "Transmission of Heat," is a long one (110 pp.), and in it the reader may find abstracted, or printed in extenso, practically all the published results of experiments that have been made on the transmission of heat through plates, from hot gases to water, that have been made in the last 50 years. If the student has an abundance of time he may undertake to digest these experiments, and find what their results really mean. Mr. Rowan has not done this for him, but seems to consider his duty as an author done when he reprints, with a few unimportant comments of his own, this undigested mess.

He gives a series of formulæ for efficiency of steam boilers, prepared by J. G. Hudson, one of which is:

> Efficiency of absorption = heat absorbed ÷ heat developed,

and criticises this self-evident statement as being indefinite, but offers no substitute. The author next gives a very full explanation of Carnot's formula $E = (T - t) \div T$, in which T and t are absolute temperatures, but fails to show that this formula relates to engines, only, and has no relation whatever to the "practical physics of the steam boiler," but that precisely the same formula, when T and t are degrees measured above the temperature of the atmosphere, and not absolute temperatures, is the formula for efficiency of a steam boiler, when T and t are respectively the temperatures of the fire and of the chimney gases.

The greater part of the chapter is devoted to abstracts of experiments on the rate of transmission of heat under different conditions, but the results are not compared in such a way that the reader may be able to draw conclusions from them; in fact, the author seems not to be very clear as to his own conclusions, for on p. 114 he throws doubt on Dulong and Petit's conclusion that the transmission is proportional to the square of the difference of temperature; on p. 170 he gives the summation of Blechynden's experiments which confirm that conclusion; and on p. 213 he quotes Rankine to the same effect. The practical bearing of this whole chapter on the physics of a steam boiler does not appear, and there is no study showing how the rate of transmission of heat may be related to the question of boiler efficiency, such as is shown in Kent's "Treatise on Steam-Boiler Economy."

The circulation of water in steam boilers is the subject of a chapter of 50 pp. It contains accounts of experiments by Watts, Yarrow, Bel'ew, Thornycroft, Milton and others, to determine how water circulates in boilers of different form, and shows that the theories of different writers on the subject are not in harmony. Then follow chapters on the influence of temperature on the tenacity and ductility of steel, and on corrosion and incrustation which contain much good matter but nothing new. A historical sketch of boiler design occupies 155 pp., and a chapter on the results of some evaporative tests, and an appendix and index conclude the book.

The author is not well satisfied with the existing status of boiler design. He says: "None of the boilers hitherto introduced have attained a performance which entitles them to be considered as even approaching finality in their design." A more correct statement would be that the economical performance of boilers properly designed,

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with furnaces adapted to the fuel, and correct methods of firing, has for 30 years or more been so high (75% efficiency or more) that there is no margin for further improvement, except such as may be made by economizers utilizing the flue gases.

The book as a whole is a disappointing one, if considered as a treatise on the practical physics of the steam boiler. It is useful, however, as a collection of information on subjects more or less related to steam boilers.

Steel Mill Buildings.

THE DESIGN OF STEEL MILL BUILDINGS AND THE CALCULATION OF STRESSES IN FRAMED STRUCTURES.—By Milo S. Ketchum, Assistant Professor of Civil Engineering, University of Illinois. New York: The Engineering News Publishing Co. Cloth; 6½ × 9 ins.; pp. 367; 29 tables, and 185 illustrations in the text. $4.

The steel mill building is a quite distinct type of structural steel work, yet there has not heretofore existed any general treatise on its design and construction. Professor Ketchum's work is the first of this kind; in thoroughness and clearness of treatment it does full justice to its subject. It is the result of both theoretical and practical acquaintance with the type of structure treated; for several years the author was engaged in the actual design of mill buildings in the office of a bridge company, and subsequently he taught structural steel work in a technical college. It may be assumed, therefore, that pedagogical and commercial requirements are considered in the treatment of different parts. Our examination of the book leads us to believe that it will prove of value as well to the designing engineer as to teachers and students of steel mill building work.

What is a "steel mill building?" The question is not easy to answer satisfactorily. Professor Ketchum does not give us much help on this point. He arranges three classes of steel mill buildings: The steel frame, the curtain wall, and the bearing wall building, respectively. The first of these is the type; it is explained as follows:

> A steel-frame mill building is made by covering a self-supporting steel frame with a light covering, usually fireproof. The framework consists of transverse bents firmly braced by purlins, girts and diagonal braces.

So far as exact definition goes, this does not indicate a structure necessarily different from the tier building. Yet, typically, the steel mill building has no floors intermediate between ground and roof, but forms a simple shell enclosing a hall-like space adapted for heavy manufacturing, milling, and similar industrial use. It is a building whose framework consists essentially of truss-work and open bracing.

The design of a steel mill building is mainly the design of the supporting framework. This is usually planned completely by the engineers of the bridge company which executes the framework. Often it falls to these engineers also to design suitable side and roof covering, windows and ventilators. In any case, the construction of these details affects the design of the framework in one way or another. A more or less complete knowledge of the commercial forms of construction of these secondary parts is therefore quite essential to successful designing. The present work shows adequate recognition of this fact.

The author naturally begins his book by discussing the character and amount of the various loads that may affect the framework. Under "Dead Loads" an excellent pair of diagrams is given for the weights of trusses of different span and spacing, for various amounts of uniformly distributed loading. These are all for 6-in. pitch trusses; by far the larger number of simple roof trusses used in mill building work have approximately this pitch. Flat roof trusses are best estimated for each case by the guide of experience in similar work. The weights of various roofing materials is also listed. Snow and wind loads are each treated in a short chapter, giving diagrams for the unit load under various conditions. Live loads are given as specified in various cities by the building authorities, and a guide is given for estimating crane loads and the loads from stored goods of various kinds.

The methods of finding the stresses in various members of a structure under given loading are very fully treated, occupying 120 pp. In fact, it may be objected that the treatment is too detailed. The author begins as far back as the beginning of Statics—the composition and resolution of two concurrent forces—leading thence up to the force polygon and the funicular polygon, before proceeding to apply the results to stress determinations. Much of this work might have been omitted. Unless the book is written for home study by persons not familiar with elementary statics (the preface states that the book "is intended to supplement the elementary books on stresses," among other things) the elementary chapter will prove of little use.

After working out various examples in simple roof trusses under uniform, concentrated and wind loads, both graphically and analytically, the author briefly considers beams (simply supported) and analyzes the stresses in beams under a system of moving loads; this applies directly to crane girders, of course. Another chapter is devoted to stresses in bridge trusses under moving loads, a discussion not very relevant to the subject. Two good chapters discuss the effect of lateral loads (wind) on transverse bents or portals; it may be hoped that this discussion, and especially the simple graphical method of substituting a framework for the column of a bent, may lead to more general and more exact calculation of wind stresses in the columns of mill buildings, a matter often passed over with vague talk about factor of safety, wind never as high as that anyway, etc. It may be noted that the discussion of "continuous portals" leaves room for doubt whether the shear is as fully distributed over the intermediate columns as is assumed.

The three-hinged and the two-hinged arch are next taken up. This matter again (on the basis we have previously assumed) may be considered unnecessary in a book on mill buildings; at any rate, the two-hinged arch, involving as it does the calculation of deflections, calls for a treatment that is more profitably studied in another connection. Moreover, arch structures never occur in typical mill building construction; they are required only in special structures, such as exposition or assembly halls, train sheds and the like, whose design is rarely in the hands of engineers not already familiar with the theory from their study of arch bridges. The specimen calculations of a two-hinged arch, which the author tabulates, show some confusion of algebraic signs, which, though the final result is not affected, may tend to befog the student.

The chapter on "Combined and Eccentric Stress" should help to direct the attention of structural steel designers to this subject. In mill building work nothing is more common than disregard of stresses due to eccentricity of connections. In regular beam work, too, the standard form of end connection produces secondary stresses in the rivets which the author calculates for one case. It may be questioned, however, whether in the latter case the eccentricity would be borne by the rivets in the web (in shear) or those in the outstanding leg of the angles (in tension); we should be inclined to assume the latter, especially as the deflection of the beam under load would tend further to relieve the web rivets. A convenient diagram is given for finding the bending and combined stress in eye-bars due to their own weight acting in connection with the tension, but as eye-bars are only rarely used in mill building work the present book is not the best place for the diagram.

The second portion of the book, entitled "Design of Mill Buildings," opens with a few general remarks on the conditions governing the design of mill buildings, and then proceeds to discuss "Framework" in a chapter of 40 pp. Here are sketched various common types of roof trusses (their relative purposes and advantages being indicated). Pitch and spacing of trusses is discussed, cross-sections of a number of typical buildings for various purposes are shown, different kinds of columns are described, and various parts of the bracing are briefly treated; then the design of truss members, columns, crane-girders, etc., is taken up by means of some illustrative examples. It may be remarked that this chapter contains no reference to the arrangement occasionally used of spacing the main columns two or three times as far apart as the trusses, and supporting the latter on longitudinal girders (which also serve as bracing) between the columns; this arrangement has important advantages in certain cases and is not rare, by any means—one of the "miscellaneous structures" described in detail near the close of the book is an excellent example.

One of the principal factors in the development of the steel mill building is corrugated iron (nowadays corrugated steel). It provides a cheap fireproof covering which will keep out the weather, even if it makes a cold building. Very properly, an entire chapter is devoted to this material, describing its application, weight, strength, and the necessary finish, such as corner and ridge cap, gable finish, etc. It may be mentioned that strength formulas for corrugated steel have in the past received much less consideration than they should have, on the part of mill building designers. Roof coverings of various kinds other than corrugated steel, are next discussed; side walls are given a separate chapter. A brief but serviceable discussion of foundations is interpolated, and then various kinds of floors are described, principally floors laid directly on the ground. Windows and skylights, their general forms of construction and approved details, ventilators and monitors with their operating fixtures, and doors are described and discussed, each in a separate chapter. We may mention that many of the details and standard constructions shown, for corrugated steel, windows, doors, etc., are taken from the American Bridge Co.'s "Standards for Structural Details."

Some remarks on making shop and erection drawings and on erection marking are followed by a good chapter on painting, in which among other things the various kinds of paint are discussed. The author then takes up estimating, both of weight and cost. Some figures are given for detail percentages (of weight) in ordinary mill building work, and a valuable list of actual shop costs.

We have already referred to the descriptions and drawings of miscellaneous structures of the mill building type, given at the close of the book. These are all taken directly from technical journals, but are for that none the less well worth the space given to them here. Among them we may note particularly the dome of the hotel at West Baden, Ind., which will give the student of the book an opportunity for stress calculation of a somewhat complicated nature, not covered by the formulas and rules of the chapters on stresses. The specifications appended to the book seem to be conservative and satisfactory. The author appears to favor a unit stress of 16,000 lbs. per sq. in. in place of the more common 15,000, and a rivet shear of 11,000 lbs. in place of 10,000.

Good City Government.

NATIONAL MUNICIPAL LEAGUE.—Proceedings of the Detroit Conference for Good City Government and the Ninth Annual Meeting of the National Municipal League, held April 22 to 24, 1903. Clinton Rogers Woodruff, Editor. Philadelphia: National Municipal League. Cloth; 6 × 9 ins.; pp. 332. $1.

The annual proceedings of this organization have won for themselves an important place in that branch of municipal literature which is devoted to municipal administration. The present volume is, to quote from the preface, "made up in almost equal parts of descriptive matter and a discussion of the fundamental questions involved" in good city government. The descriptive matter includes, first, a review of "The Year's Work," by the editor and secretary, in which the recent municipal progress of the country is outlined and commented upon. Next come papers on "The St. Louis Disclosures," and "The Minneapolis House-Cleaning." These papers are followed by others on the municipal situation in Wisconsin, Detroit, Chicago, Indianapolis, Ohio, and the Philippines, each by a separate author.

The fundamental questions discussed include committee reports and separate papers on uniform municipal accounting and instruction in municipal government, a group of papers on the federation of societies devoted to municipal affairs, and

a paper on nomination reform. There is also a proposed constitution for a "Civic Alliance," designed, as the document declares, to establish "a central office in touch with civic effort in all parts of the country, affording a common bureau of information," and "to bring about a federation of existing organizations." The proposed constitution was drafted, in the main, by Mr. Clinton Rogers Woodruff, Secretary of the National Municipal League, and Mr. Charles Mulford Robinson, Secretary of the American Park and Outdoor Art Association. The volume before us includes a paper on the relation of the more strictly technical societies to federation, by Mr. C. C. Brown, M. Am. Soc. C. E., of Indianapolis, Ind.

The report of the committee on uniform municipal accounting, but without the supplementary papers, has been published in pamphlet form, and may be obtained by addressing the Secretary of the League, 121 South Broad St., Philadelphia.

An English View of American Railways.

AMERICAN RAILWAYS.—By Edwin A. Pratt. Reprinted, with Additions, from the London "Times." New York: The Macmillan Co. Cloth; 5½ x 8 ins.; pp. 309. $1.25.

This book is the outcome of a visit paid to this country by the author for the purpose of investigating the conditions and methods of American railways and railway practice. It is well and clearly written, and treats the subject more fairly than has been the case with some other similar publications, the author evidently considering the matter with an open mind and with as little prejudice as could be expected. While the book is interesting from a popular standpoint, it is less satisfactory from a professional standpoint, since it has the drawback of being written by one not familiar with railway affairs or management, so that many matters are overlooked or treated from a wrong point of view.

To take just one instance, after giving extracts from the reports of the Interstate Commerce Commission, referring to the defects in automatic couplers, he expresses the opinion that these reports should suffice to kill the movement for the compulsory use of automatic couplers on English railways. He fails to see that it is not the automatic coupler in itself which is the source of the objections, but that the objections are due to defects in manufacture and maintenance. He might also have learned in railway circles that much time and thought are being given to the problem of perfecting both the manufacture and maintenance of the couplers, the use of automatic couplers being universally approved. In regard to track construction, he quotes Lieut.-Col. Yorke, who also recently investigated American railways, as saying that "the effect of tie-plates is to shear off the heads of the spikes." This is an error due to generalizing too broadly. It would be more correct to say that in a few isolated and exceptional cases, tie-plates have been found to shear the heads of spikes, but the value of the tie-plate in supporting the rails and decreasing the wear of ties is evidenced by the fact that they are used on thousands of miles of track and that their use is continually extending.

The author gives as his conclusion on the subject of American railways the following statement, which he credits to an American railway official: "British methods are well adapted to meet British conditions, just as American methods are well adapted to meet American conditions, and there is very little for either to learn from the other." This is an easy way of disposing of the subject, but the statement is distinctly incorrect, for there are innumerable points upon which railways in either country may learn wisdom from railways in the other country. That this is so is shown by the reports made by railway officials who have crossed the Atlantic to investigate the methods of English and American railways. The introduction by Engish railways of large freight cars to carry economically freight that is handled in large quantities, and their introduction of systematic methods of statistical accounting, are evidence that they have learned something from this country, and American railways will probably in the future introduce something of the English practice in the rapid handling of small shipments of freight.

The book is not sufficiently technical to warrant a very close analysis of its contents, but it seems advisable at least to call attention to its shortcomings and to the fact that it cannot be considered as at all a work of authority on railway affairs.

To come down to a general consideration of the book, we find first a brief survey of the situation, in which the author outlines the entirely different conditions under which the railway systems of England and America have been developed. In England they traversed a settled country with large industries, and replaced the stage coach and the wagon. In this country they were largely pioneers, opening up to settlement regions that were practically unknown. He then discusses some points of difference, with statistics (for 1901), some of which are summarized below:

	United States.	United Kingdom.
Miles of railway	195,886	22,078
Miles of track (ex. of sidings)	210.435	35,993
Percentage of double track	7.5%	55.8%
Capital per mile of railway	$59,465	$228,305
Capital per mile of single track	$55,540	$140.040
Locomotives per 100 miles	20	98
Passenger cars per 100 miles	18	307
Freight cars per 100 miles	719	3,161
Passenger receipts per mile	$1,760	$10 610
Freight receipts per mile	$5,790	$11.995
Maint.-of-way and equip. per mile.	$2,035	$3,365
Ratio, operatg exp. to gross earngs	69 01%	63%
Employees per 100 miles	548	2,635
Net return on capital	4.45%	3.87%

The development of freight and passenger traffic and equipment is then dealt with, and an American railway official is quoted in praise of the way in which light freight is handled in England. A table is given of American and English railway fares for trips of similar length. Other matters discussed are the sorting and classification work in freight yards, and the Chicago track elevation work. In regard to terminal traffic, it is remarked that the South station at Boston, used by several companies (and the larger of the two terminal stations in that city) is used daily by 801 trains carrying 68,500 passengers. At London, however, the Liverpool St. terminal of the Great Eastern Ry., which is only one of a number of large railway terminals, is used daily by 1,100 trains (80 during one hour) carrying 169,000 passengers. But the author overlooks the important factor of population, and omits to note that while Boston has a population of 561,000, the Administrative County of London has a population of 4,536,500, besides which there are 2,045,000 in the "Outer Ring." Several chapters, covering some 120 pages, are largely of a popular character, containing the author's experiences and notes of travel on different journeys, all very interesting and readable, and showing the history and development of some of the main lines of railway and those sections of the country which they serve.

In conclusion, it may be said that while the book is not an authoritative treatise, yet it is eminently readable and interesting, and gives a very good idea of the way in which American railways impress the "intelligent foreigner" who is receptive rather than merely critical. It also enables us, to some extent, "to see ourselves as others see us."

Railway Transportation.

AMERICAN RAILWAY TRANSPORTATION.—By Emory R. Johnson, Ph. D., Assistant Professor of Transportation and Commerce in the University of Pennsylvania; Member of the Isthmian Canal Commission, 1899 to 1903. New York: D. Appleton & Co. Cloth; 5¼ x 8 ins.; pp. 434; illustrated. Price, $1.50 net; by mail, $1.65.

The field covered by this book is briefly defined by the author in his introductory chapter as follows:

This volume is concerned with the transportation service performed by steam or trunk-line railroads. It does not discuss the engineering and other technical questions of railroad construction and operation, but describes the American railroad system, gives an account of the service performed by the different branches of the railroad organization, considers the business relations of the railroads and the public, and discusses the problems of government regulation. The book is a study in railway economics.

While the author has not written an engineering treatise, he has produced a book which will interest many engineers, particularly the younger members of the profession who often come out of school lamentably ignorant of commercial matters. If such a youth enters the railway service it will be worth his while to learn all he can concerning the organization of the great industry of transportation, and to study such a book as this is a far quicker and more systematic way to gain such knowledge than to pick it up haphazard.

The contents of the book are classified in three divisions: Part I. is chiefly historical and descriptive; Part II. describes the railway service; Part III. explains the relations of the railways to the public, and Part IV. the relations between the railways and the state.

On page 62 the author gives an interesting grouping of American railways by ownership. It is curious indeed to see how the names of American multi-millionaires recur in the classification, which is substantially as follows:

	Mileage.
Vanderbilt roads	20,248
Pennsylvania system	19,301
Morgan roads	11,220
Morgan and Atlantic Coast Line roads	10,051
Gould roads	15,504
Moore roads	13,003
Hawley roads	2,316
Harriman roads	16,488
Morgan-Hill roads	22,507

The historical part of the book is excellent. Two maps are printed, showing the canals and railway systems of New York and of Pennsylvania as they existed in 1840. It is difficult to realize now that at that time the canal was much the more important means of transportation. The historical feature is not confined to the description of the railway as a machine, but is carried all through the book. Thus in the chapters on the express service and on the mail service, there are accounts of their early development. The chapter on pools and traffic associations reviews briefly but thoroughly the history of these organizations. Under "State Regulation," there is an extended account of the past practice of various countries in this respect.

The general tone of the book is conservative. For the most part, the author presents merely facts, but where he introduces his own comments they are in general sound and well grounded.

The Evolution of Industrial Society.

STUDIES IN THE EVOLUTION OF INDUSTRIAL SOCIETY.—By Richard T. Ely, Professor of Political Economy and Director of the School of Economics and Political Science in the University of Wisconsin. New York: The Macmillan Co. Half leather; 5 x 7½ ins.; pp. 497; tables. $1.25 net; by mail, $1.35.

In this addition to "The Citizens' Library of Economics, Politics and Sociology," the editor of the series reviews a broad field. His treatment is generally interesting and suggestive, but portions of Part I., which is a general survey of the evolution of industrial society, seem more in the nature of a compilation of curious facts than a scientific discussion of the subject.

The book as a whole deserves commendation for seizing upon and exhibiting many of the vital questions of the day. These questions pertain to what the author describes as "that general borderland where economics, ethics, biology and sociology meet." We are far too prone to forget that we are, or should be, first of all, men, and after that merchants, manufacturers or engineers; and consequently we need to be brought back, every now and then, to the human side of life. But even if one denies this need the book before us still furnishes sufficient material for reflection.

The author first briefly discusses evolution as worked out by Darwin and Spencer, and as applied more particularly to industrial society. He then takes up the hunting, pastoral and other economic stages, down to the industrial, after which economic classes and "Recent Tendencies of Industrial Evolution" are discussed. In the concluding portion of the chapter bearing the foregoing title the author states that "competition is the foundation of our social order," but industrial evolution is resulting in "widespread monopoly." Both competition and monopoly must be regulated. Co-operation must increase. Our industrial problem is: "How shall we retain the advantages of associated effort with freedom of

movement and a socially desirable distribution of products."

The first section of the book closes with numerous statistical tables showing the industrial and social progress and status of the United States.

In Part II. many and various specific problems of industrial evolution are discussed, such as competition, trusts, municipal ownership, concentration and diffusion of wealth, public expenditures, the labor problem, ethical obligations and, finally, "The Possibilities of Social Reform."

Brief critical bibliographies are appended to many of the chapters, and are a useful feature of the book. The tone of the author is optimistic throughout. He concludes by declaring what most of us too often forget, that "The present duty of each one is to contribute his full part, in accordance with his strength, to individual and social improvement."

New Curve Tables.

CURVES OF CIVIL ENGINEERING.—The Transitman's Pocket Companion, Containing Instructions for Surveys to Locate the Center Line of Engineering Works, and Tables that are Needed in the Field, in Connection with Circular, Transition and Vertical Curves. By Arthur M. Haynes, C. E. Denver: The Author. Leather, with flap; 4 × 7 ins.; pp. 117; tables and diagrams. $2.50.

This little book differs from all others on the subject in that the tables are designed to be used in laying out curves measured on the arc of the circle, and not along the chord. It is true that in actual field work the tape or chain is to be held along the chord, but the rear-chainman is to hold back a certain length on the chain so that in effect the station stakes will come at even hundred-foot intervals measured around the arc of the curve. Thus, for a 9° curve the chainman holds off 0.1 ft. on each 100 ft. chord to allow for the excess of arc over chord distance. The "degree of curve" is defined as "the number of degrees in an arc of the curve 100 ft. long;" and the table of functions of a 1° curve is based upon this new definition. This table occupies 70 pages of the book. Comparison with similar tables in other field books shows very slight numerical differences; for example, where the intersection angle is 90° the tangent distance in this table is only 0.1 ft. less than in Henck's table, while the external is the same in both.

There are some features about this new curve that differentiate it from others. It gives not only the tangent distance and the external for every two minutes of intersection angle, but it gives the long chord also. In addition, it gives the length to be added for each of three different kinds of transition spiral. The spirals used are designated as No. 5, No. 9, and No. 14, which the author regards as being all that are needed in railway practice. No. 5 is "Searles spiral," to be used on easy curves of prairie roads; No. 9 is used on the Union Pacific Ry., after Holbrook's plan; and No. 14 is designed for the sharp curves of mountain lines.

It is stated by the author, and a study of the curve table makes it obvious, that this book can also be used in field work where the degree of curve is the number of degrees subtended by a 100-ft. chord; so that while the author advocates the 100-ft. arc as the unit, his tables are by no means confined to that method of measurement.

The author maintains that especially where very sharp curves are used, as in roads, drainage ditches, street railways, and the like, greater accuracy and saving in time are effected by the curve measurement advocated by him. He will find it difficult, we anticipate, to effect any change in existing methods on ordinary railway work.

The book is not written as a text book for students of railway location, nor even as an office book. There is only one figure illustrating a curve, and that is a transition curve. There are no tables of logarithms, sines, cosines or other functions of the right-angled triangle, with the exception of one very small table of natural sines, occupying a single page. The author contends that such tables are superfluous in a field book. Special problems are considered as belonging to the class room, and are therefore omitted.

We believe that the author has erred in being too concise, and in assuming that field books should be used only by well-trained men. The average transitman will long continue to feel the need of field books that do contain illustrations, formulas and discussions which may seem superfluous to the trained expert in railway field work; and this, we believe, will hold true even when the transitman is a graduate of an engineering college.

A New Edition of Hodgman's Land Surveying.

A MANUAL OF LAND SURVEYING.—Comprising an Elementary Course of Practice with Instruments, and a Treatise Upon the Survey of Public and Private Lands, Prepared for Schools and Surveyors. By F. Hodgman, M. S., C. E. Climax, Mich.: The Author. Leather; 4½ × 6½ ins.; pp. 394 + 106; tables and diagrams in the text. Star edition, $3. Tables separate (126 pp., same binding), Star edition, $1.50.

This manual needs no introduction to surveyors, with whom it ranks as the best by all odds of the practical hand books on the subject of land surveying. The volume before us is one of the tenth edition, and it appears to have been very thoroughly revised. Among the additional information which it contains, compared with previous editions, are the gist of the 1902 "Manual of Instruction for the Survey of Public Lands" of the United States, new matter relative to resurveys and subdivisions of sections, a large addition of recent court decisions bearing on the work of the land surveyor, and additional answers to practical questions on land surveying. The character and quality of these additions need no explanation to those who are familiar with former editions of the manual. As the pioneer of surveying manuals, it will not be out of place to state briefly here some of the items on which it was the first to give practical and much needed information. It was the first to present the problem of connecting a random line of two or more courses, the first to give instructions for subdividing sections of the United States survey, the first to call attention to the difference in principle between original surveys and resurveys, and the first book on land surveying in which the legal principles governing the location of boundary lines were given.

The "Surveyors' Tables" forms a companion volume to the manual, and its purpose is to supply separately and in greater measure all the tables ordinarily used by the land surveyor in the computation and recording of his work. They comprise logarithms, natural and logarithmic trigonometrical functions, traverse tables and a number of minor tables.

A Study for an Interurban Electric Railway.

ENGINEERING PRELIMINARIES FOR AN INTERURBAN ELECTRIC RAILWAY.—By Ernest Gonzenbach. New York: McGraw Publishing Co. Cloth; 6 × 9 ins.; pp. 71; 5 illustrations in the text. $1.

This little book is an outline of the design of line and equipment which the author recommended for a 60-mile interurban electric railway. Its general purpose is, apparently, to show how the design of such a line must be worked out when it is desired to construct not a transportation line of maximum mechanical efficiency, but an investment property of maximum earning power consistent with suitable engineering development. The case discussed was one where the probable income of the line (as determined by careful estimate of the tributary region and comparison with closely similar lines) was by no means an unlimited quantity, but an amount which made studied economy in design necessary if the line was to pay dividends. One of the first points which was affected by this necessity was the electrical equipment of the line. The author expresses the opinion that there has been a great deal of unwise investment in the way of high-powered or virtually "elevated-road" motor equipment on country lines; that the power house is often lavishly equipped at the expense of the car equipment and roadbed; and that in general the merely mechanical and "operating" elements of the system very often receive scant attention in comparison with the electrical equipment. This is expressed concretely in one of the closing paragraphs:

> A summary of the recommendations made and a comparison with some recently-built and heavily financed properties shows that it is recommended to invest less money in electrical equipments, power house, transmission line, substations, track rails and third-rail. It is recommended to invest more money in track ballast, car bodies, trucks, block signal system and waiting stations.

A good automatic signal system is strongly recommended by the author, primarily as an investment, in the way of insurance against accidents:

> An automatic block signal system is a necessity on a road of this character. One needs only to examine the list of accidents which have occurred on electric railways during the last year or two to be convinced of this.

The same matter is again strongly emphasized on another page of the book, where the sloppy methods of dispatching in vogue on many electric railways are condemned.

A special form of train schedule, using cars which run half the way limited and the remaining distance local, is a feature in the design outlined. The third-rail is adopted in preference to the overhead trolley, on the basis of a diagram which shows that the former is the cheaper, even down to the smallest sizes. Closely-spaced substations, with a waiting room and station-stop semaphore in connection, constitute another of the special features recommended for this road.

The book appears to be a reprint of articles from a technical paper. This is not sufficient reason, however, for the carelessness and haste in the make-up of the book, evident at several points.

Pickworth's Slide-Rule Manual.

THE SLIDE RULE.—By Charles N. Pickworth. Eighth Edition. Manchester and London, England: Emmott & Co. New York: D. Van Nostrand Co. Cloth; 5 × 8 ins.; pp. 104; 19 figures in the text. 80 cts.

A work that reaches its eighth edition in eight years may be assumed to have sufficient reason for existence. That reason, we are inclined to think, is the fact that the slide rule is adapted to be used and is used by a great many men who, through not being versed in logarithmic competition, are unable to deduce for themselves the methods of the various calculations possible with the instrument. For these men a book like the one under review is indispensable. Among the other class of users of the slide rule, comprising those who are familiar with logarithmic calculation, nearly every one, doubtless, works out his knowledge of the slide rule directly from the principles of logarithms. While this should be quite sufficient for the purpose, it may be asked, how often does such a man use the slide rule to find a cube root, for example? Cube roots are found nearly as easily as square roots, on the slide rule, but very often the possessor of the instrument has never searched into its possibilities beyond the functions of simple multiplication, division, and squares and square roots. A slide-rule manual will be found suggestive in pointing out and explaining the less common applications of the instrument. The solution of simple quadratic equations is a case in point.

The discussion of special slide rules in this book is somewhat less complete than it might be. At any rate, the Thacher rule, which is in regular use for a considerable amount of computing, in this country, is passed by with a mere mention, which may be explained by the fact that the book is English. However, the essential part of the text, that dealing with the simple Mannheim rule, is very full and clear. Tables are given of constants for various computations and for the conversion of different systems of measurement, which should be of value to every user of the slide rule.

The degree of accuracy of the slide rule and the sources of error in its manipulation are probably best understood from individual observation. We may, however, quote one remark on this subject, contained in the preface, where it is apt to be overlooked by some readers of the book:

> It may be remarked that with the ordinary logarithmic scales the percentage error due to a slight displacement of the scale is constant throughout the length of the rule. This fact may be roughly but convincingly shown by setting 1 on C to, say, 1.01 on D, giving an error of 1%. Then the corresponding readings at 2, 6, 8, etc., will be 2.02, 6.06, 8.08, etc., each reading showing a uniform error of 1%.

The popular impression that greater accuracy is obtained in the first part of the scale, where the divisions are to smaller units, is based on the criterion of number of places rather than on the more correct one of percentage error. On the latter basis, as assumed in the above quoted remark, the accuracy of the rule does not vary much over different parts of the scale.

Another Addition to Forestry Literature.

PRINCIPLES OF AMERICAN FORESTRY.—By Samuel B. Green, Professor of Horticulture and Forestry, University of Minnesota; Member of the Forest Reserve Board of the State of Minnesota. New York: John Wiley & Sons. London: Chapman & Hall. Cloth; 5 × 8 ins.; pp. 334; 73 illustrations, including plates. $1.50.

The many recent additions to forestry literature are gratifying indications of an awakening to the importance of a sadly neglected subject. Professor Green's new book is a sane and practical presentation of forestry principles, with special reference to Minnesota and the Central West. In some respects it seems better suited to the needs of the student, using that word broadly, than any of its predecessors, since it is not too elementary to be useful, and not too advanced to be within the comprehension of any person of fair education. The author states in his preface that the book is designed for students (in the narrower sense of the word) and also "for the general reader who wishes to secure a general idea of the subject of forestry in North America." He also says that much of the matter originally appeared as a public document under the title "Forestry in Minnesota," in which form it met with so much favor as to lead to a more general treatment, adapted to the whole country.

Nearly all phases of forestry are taken up in more or less detail. Particular attention may be called to the chapters on forest influences, including their effect on water supplies, rainfall, wind and temperature; on tree planting on the prairies; on seed gathering, storing and sowing; on nurseries; and on rate of increase of timber trees. About 40 pages are devoted to a tabular classification and description of important American timber trees, including the common and scientific names, height and diameter, geographical distribution, quality and uses of wood, and remarks on the more general characteristics of the tree, such as its most favorable environment, rate of growth, and esthetic appearance. There are also a glossary, short lists of the best American and foreign books on forestry, and forestry publications of the U. S. government.

The illustrations are generally satisfactory, and include some good half tones. There is a serviceable index, although such entries as "broken branches" and "blowing out of small seedlings" cannot be commended, especially when references to the same topics are not found under "branches" and "seedlings," respectively.

Timber Tests in Argentina.

MADERAS ARGENTINAS, ENSAYOS DE RESISTENCIA DE.—By Emilio Palacio, Professor of Materials of Construction in the Faculty of Exact Sciences, National University of Buenos Aires, Buenos Aires, Argentina: The Facultad de Ciencias Exactas, Fisicas y Naturales, Universidad Nacional de Buenos Aires. Paper: 7 × 10 ins.; pp. 64; 27 illustrations; 8 tables.

The results of rupture tests of 22 different varieties of Argentine timber are recorded in this pamphlet. Tests were made in (1) tension, (2) compression along fibers, (3) compression across fibers, (4) shear along and (5) across fibers, and (6) bending. In the case of bending the modulus of resistance was determined both at rupture and at the elastic limit; moreover, the latter quantity was employed in conjunction with the elastic deflection to determine the modulus of elasticity of the material. The results of the tests are summarized in eight tables appended to the text, and specimens of test pieces after rupture are shown by photographic views. Several stress-strain diagrams of bending tests are also reproduced.

A rather special feature of the tests may be noted here: The tension test pieces were plain rectangular sticks, 5 × 2 cm. in section, held at the ends between the wedges of the testing machine. In spite of the absence of enlarged ends, no specimen broke in the wedges, but every rupture occurred in the clear length. In order to more fully establish the correctness of this method of testing, some varieties of woods were tested both in this form of tension test piece and in the usual form with enlarged end sections; the results in each case checked closely, and the other tension tests were therefore all made with the plain prismatic sticks.

To the report of the tests is appended an illustrated description of the testing laboratory at the Faculty of Exact Sciences of the University of Buenos Aires.

LOGARITHMIC THREE-VARIABLE DIAGRAM FOR THE GRAPHICAL SOLUTION OF GAS-ENGINE PROBLEMS.—By Harrison E. Ashley, S. B., New Bedford, Mass. Paper; 7 × 10 ins.; pp. 16; 8 drawings in the text. Reprinted from "Technology Quarterly," Vol. XIV., No. 4.

A formula of the form $a + b + c = k$, representing for example the percentage constitution of an alloy containing three metals, or a slag containing three main components, is most commonly expressed graphically by an equilateral triangle, in which the perpendiculars to the three sides from any interior point sum up to a constant. The author some time ago showed how a right-angled triangle may be used for the same purpose; the distance from the right angle along one of the sides represents the one constituent, while the ordinate to the hypothenuse represents the sum of the other two constituents. In the present essay the author applies this principle to a formula of the type $a\ b\ c = k$, or $\log a + \log b + \log c = \log k$, by using logarithmic scales of abscissas and ordinates. The law of gases, $pv = Rt$, is of this type, and hence may be represented by such a diagram.

The adiabatics prove to be straight lines, inclined at an angle to the axes. The author suggests the use of the diagram for the solution of gas-engine problems, since a cycle diagram consists only of straight lines. It is also indicated that the diagram may be applied to the more general formula $a^m b^n c^p = k$, since this equals $m \log a + n \log b + p \log c = \log k$, which differs from the original case ($a + b + c = k$) merely in changing the abscissa and ordinate scales.

PIPE GALLERY EXPERIENCE.—A Report Prepared at the Request of Hon. Jacob A. Cantor, President of the Borough of Manhattan (New York City). By James C. Bayles, Consulting Engineer. New York: City Doc. Paper; 6 × 9 ins.; pp. 33; figures in the text.

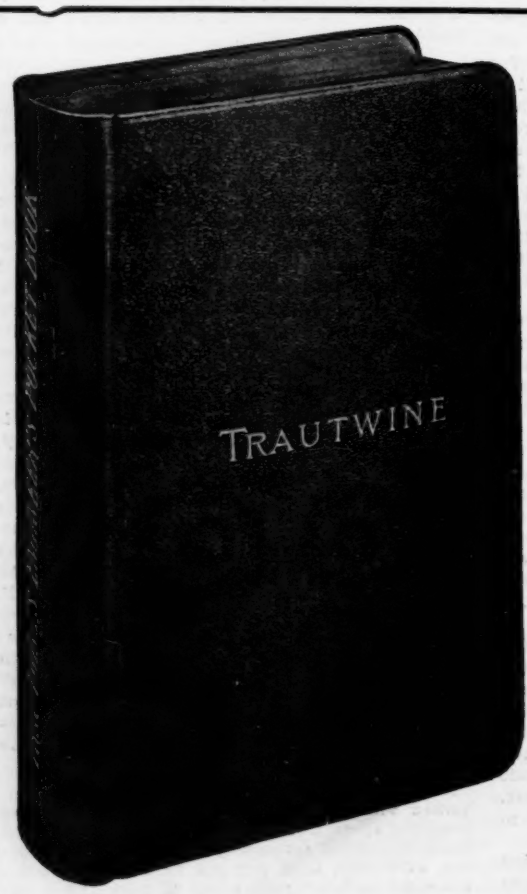
The author has here brought together in convenient form descriptions of perhaps all the pipe galleries, or subways for street pipes, and in some cases both pipes and wires, now in existence. These descriptions include the galleries at London, Nottingham and St. Helen's, England, at Paris and at Milan. With the exception of London, where use of a recent report has been made, the author seems to have based his descriptions on the same original authorities as were used by us in preparing an editorial review of subways for pipes and wires in our issue of March 15, 1900. Mr. Bayles, however, has described these various subways in more detail than we did, and has used more illustrations. In addition to foreign examples, the author discusses the need of similar galleries or subways in New York, and gives some interesting statistics of gas leakage where the mains are buried in the old-fashioned way. He also gives some statistics relating to street openings in New York. As some of our readers may know, the city of New York, after letting slip the opportunity to build pipe galleries along the original lines of the Rapid Transit Railroad, has subsequently provided for such galleries on the lower Broadway extension.

NEW YORK STATE GEOLOGIST.—Report for 1901. Reprinted from the 55th Annual Report of the New York State Museum, Frederick J. H. Merrill, Director and Geologist. Albany, N. Y.: University of the State of New York. Paper; 6 × 9 ins.; pp. 99; 36 folding and other plates. 40 Cts.

The two papers in this belated report most likely to interest our readers are: "Uses of Peat and Its Occurrence in New York State," by Heinrich Ries; and "Molding Sand; Its Uses, Properties and Occurrence," by Edwin C. Eckel. The first of these two papers is quite long and the last is short.

Trautwine's Civil Engineer's Pocket Book

New (18th) Edition; 70th Thousand; 1902



370 Pages of New Matter

including digest of specifications for bridges and buildings and for iron and steel, conversion table of units of measurement, price-list and business directory of manufactured articles, bibliography, trusses, statics, strength of beams, cement, concrete, etc.

JOHN WILEY & SONS
43 East 19th Street
New York

Literary Magazines.

"The Wastes of a Great City" is the title of the leading paper in the October "Scribner's," written by Dr. John McGaw Woodbury, Commissioner of Street Cleaning of New York City. It is risking nothing to say that in the sanitary and economic handling of the wastes of a metropolis, greater success has been attained by the present municipal administration than has ever been reached before by any city in this country. The actual street cleaning is a very small part of the department's work. Its most difficult problem is how to get rid of the refuse matter ejected from the houses of four millions of people, and to do this with the least offense to sight and smell and with due regard to economy. The fact that the garbage with which New York city has to deal is vastly different from the wastes of foreign cities is emphasized by Dr. Woodbury. New York garbage contains about 25% more water than the garbage of English or Scotch cities and about 50% more than the garbage of German cities. It is of interest to note that the street sweepings of New York have been delivered to the Long Island R. R. for the past year to the amount of 1,600 sacks daily. The material has been used by the railroad company as a fertilizer to aid in starting a growth of grass upon its embankments and the slopes of cuttings along its lines.

"Some Phases of Trade Unionism" is the title of another "Scribner" paper from the pen of Prof. Walter Wyckoff, of Princeton University. Mr. Wyckoff treats his subject from the historical standpoint and with a sympathetic appreciation of the wage-worker's position, while condemning the errors into which the unions have too frequently fallen. His paper is worth study by any who wish to understand the labor question from a broad standpoint. No unprejudiced observer doubts that the unions are here to stay; the question is, how can they be turned from their errors and indefensible excesses.

In the "Atlantic" we find a forcible paper on "The Power of the Senate" by Mr. S. W. McCall, in which is set forth in plain terms the extent to which the Senate has usurped powers that are not given to it by the constitution. "The only practical hope of even a partial remedy," declares Mr. McCall, "lies in the jealous insistence by the House of Representatives upon its constitutional prerogatives."

In the October "Century" we find a paper on "The Destruction of Philae," the famous island in the Nile, covered with beautiful old temples, which has been partially submerged by the rising of the waters stored by the great Assuan dam. The author of this paper says that the water is rapidly disintegrating the soft stone of which the temples are built and that probably these structures which have endured for thousands of years will soon be destroyed. In the same magazine Gen. A. W. Greely gives a graphic account of the work of the U. S. Signal Corps in the Spanish war.

British and French submarine boats form the subject of a paper by Mr. Archibald S. Hurd in the current "Forum." Both England and France are now engaged in extensive work in submarine boat construction and trial. The French type of boats are small vessels, while the British are building large boats capable of high speed—making a submersible torpedo boat, in fact, rather than a submarine boat proper.

The "Review of Reviews" contains a most interesting paper on "Reciprocity Between the United States and Canada." In the year just closed the trade across our northern border amounted to $180,000,000, the balance of trade being greatly in our favor. Unless reciprocity is adopted, however, Canada is likely soon to raise its tariffs to the level of our own and our trade will suffer a great decline. The writer of the article urges, therefore, that a reciprocity treaty be negotiated. In the same magazine there is a review of the socialistic legislation of New Zealand, where the Government owns all railways, telegraphs, telephones, water, gas, and electric plants, carries on savings banks and insurance companies and even loans money on real estate mortgages.

In the "North-American Review" for October, President Thwing of Western Reserve University writes on "College Training and the Business Man." He takes the view, of course, that the college education for a youth looking forward to a business career is worth the four years of time and the money that it costs. His argument is reinforced by numerous quotations from the opinions of prominent business men.

"Flood Prevention and Irrigation: Twin Ideas," is the curious title of another "North American Review" paper, written by U. S. Senator J. R. Burton of Kansas. The idea expressed is that by building reservoirs on our western rivers they will both store water for irrigation and prevent disaster from floods. There is, of course, a measure of truth in this when applied to mountain streams in the arid regions; but for the rivers of the central west in the region of normal rainfall it is quite another matter. An idea of Senator Burton's knowledge of the subject may be gained from the fact that he proposes to build his reservoirs not by building dams, which "ever involve an element of danger" but by utilizing "the depressed basins which may be found naturally formed in many places and may be constructed with little expense in others. . . . Where nature has not provided the reservoir, it should generally be dug into the earth." Fortunately Senator Burton, while he urges national appropriation for his scheme, would have the work undertaken only after the most complete surveys by engineers: "The channels should be studied and their carrying capacities gaged, the rainfall accurately measured, the amount of water at its flood fully determined and the approximate expense of impounding the waters ascertained." After he has done this, the difficulties in the reservoir system of flood control in the Mississippi Valley will become more apparent to him.

THE MINERAL INDUSTRY.—Its Statistics, Technology, and Trade in the United States and Other Countries to the End of 1902. Founded by the Late Richard P. Rothwell; Edited by Joseph Struthers, Ph. D. Vol. XI. New York and London: The Engineering and Mining Journal. Cloth; 7 × 10 ins.; pp. xxx. + 912; plates, tables, and figures in the text. $5.

This well-known publication contains not only its usual array of statistics on the mineral and metallurgical products of the United States for the year covered, but in addition there are a number of exceptionally valuable papers, the titles of some of which are as follows:

Progress in the Aluminum Industry, by John B. C. Kershaw; Petroleum and Maltha Products Used in the Paving Industry; by A. W. Dow; The Mechanical Equipment of a Modern Portland Cement Plant, by Frederick H. Lewis; Review of the Literature of Clay and Clay Products, by Heinrich Ries; Progress in Gold Milling During 1902, by R. H. Richards; Notes on Progress of Iron and Steel Metallurgy, by Frederick Hobart; Recent Improvements in Lead Smelting, by H. O. Hoffman; Progress of Metallurgy, by William Campbell; Concentration of Ores by Oil, by Walter McDermott; Sampling and Estimation of Ores in a Mine, by T. A. Rickard.

Besides these longer papers there are many short ones summarizing the literature of the year 1902, relating to the production and manufacture of mineral, metallurgical and chemical products.

PROCEEDINGS OF THE AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Chicago: The Association. Paper; 6 × 9 ins.; pp. 549; illustrated. Price: Paper, $2; cloth, $2.50; half morocco, $3.

This volume contains a full report of the proceedings of the fourth annual convention, but does not contain all the committee reports prepared for the convention. As was pointed out in the account of the convention published in Engineering News last March, so much attention was given to some of the committee reports that others had to be simply presented by title or as reports of progress. According to the regulations, only those reports which have been considered by the convention can be published in the proceedings, so that out of a dozen reports only five are included in the present volume. These reports are as follows: (1) Roadway; (2) Iron and Steel Structures; (3) Signaling and Interlocking; (4) Yards and Terminals; (5) Masonry. In addition to the reports, discussions, etc., there are lists of members and of railways represented, the constitution and by-laws, list of committees, and other miscellaneous matter.

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Irrigation Bulletins and Reports.

EGYPTIAN IRRIGATION.—A Study of Irrigation Methods and Administration in Egypt. By Clarence T. Johnston, Assistant Chief Irrigation Investigations. Washington, D. C.: U. S. Department of Agriculture. Paper; 6 × 9 ins.; pp. 100; 25 plates and 9 figures in the text.

This is no compilation made in a library thousands of miles from Egypt, but is the result of a visit to that country made by Mr. Johnston in the winter of 1901-2. One gains the impression, both from the author and from the letter of transmittal by Mr. Elwood Mead, Chief of Irrigation Investigations, that there is less of practical value for American irrigators and engineers to learn from Egypt than was anticipated before Mr. Johnston went to that country. Mr. Johnston states that the lessons of Egypt are of negative value, so far as practical irrigation is concerned, but finds much "significance and promise to the arid commonwealths" of this country in "the showing of yield and profits of irrigated land in Egypt." It is indeed wonderful that:

> This little tract of agricultural land, no larger than the irrigable area of California, supports between 5,000,000 and 6,000,000 people, pays the expenses of a costly government, and meets the interest on a national debt half as large as our own from the returns on agriculture alone.

When we learn that "irrigators in Egypt are paid 15 cts. a day," the wonders connected with so large a population on so small an area diminish somewhat, but nevertheless the productiveness of even the fertile Nile valley under irrigation is full of promise to our West, with all its enterprise and industrial progress.

Mr. Johnston presents a brief "general view of Egypt," describes its canals, water-raising devices, both primitive and modern, and describes and illustrates the Cairo barrage, the new Assuan dam and reservoir, and the Assiut dam. The laws and regulations governing irrigation in Egypt are also given in detail. The volume contains some handsome and interesting half-tone views, some reproductions of wash drawings, and some well-executed line cuts.

IRRIGATION INVESTIGATIONS FOR 1902.—Under the Direction of Elwood Mead, Chief of Irrigation Investigations. Containing Reports by E. R. Morgan, J. D. Stannard, B. P. Fleming, O. L. Waller, S. Fortier, W. T. Clarke and C. W. Landis, A. B. Crane, Frank Bond, J. C. Nagle, H. J. Waters, A. R. Whitson, E. B. Voorhees, and Jared Smith. Washington, D. C.: U. S. Department of Agriculture. Cloth; 6 × 9 ins.; pp. 266; tables, 12 plates, and 16 figures in the text.

This report contains all the measurements made under Mr. Mead's direction in 1902 to determine the duty of water, and also a large amount of other material of a local character relating to the flow of streams and the distribution and use of water in irrigation. The several agents and experts named on the title page have reported on various large and small districts, from a single, relatively small drainage area to a whole state. Deep and shallow wells, pumping, storage, water rights, seepage, experiments on the prevention of seepage, rice irrigation in Louisiana and Texas, and irrigation experiments and studies in the states of Missouri, Wisconsin and New Jersey are among the subjects taken up in the volume. As usual in these bulletins, there are a number of excellent half-tones. Dr. A. C. True is Director of the Office of Experiment Stations, under which division of the U. S. Department of Agriculture this work falls.

COLORADO IRRIGATION WATERS AND THEIR CHANGES.—By William P. Headden. Fort Collins, Colo.: Agricultural Experiment Station. Paper; 6 × 9 ins.; pp. 79; tables.

The studies herein recorded are based largely on chemical analyses, for contained minerals, of surface and ground water, and of water from drains in irrigated land. In addition, use was made of observations of total solids and silts. Most of the samples studied were from the Cache a la Poudre River. An attempt was made to show both the good and bad effect upon irrigated lands of the various mineral salts in the water.

IRRIGATION IN MADRAS, INDIA.—Triennial Revenue Report of the Public Works Department, Irrigation Branch, Madras, for the Three Years Ending 1901-2. J. P. Davidson, Ag. Chief Engineer for Irrigation. Madras, India: Pub. Doc. Cardboard; 8 × 13 ins.; tables, folding maps and diagrams. $4.40.

The plan of this report is new, in that it covers three years, instead of one, and gives comparative figures for other triennial periods. Nine major and 32 minor irrigation works for which capital and revenue accounts are kept are included, besides many small works for which no accounts are kept. Some idea of the extent of the works reported on may be gained from the fact that for the three years ending with 1901-2 an average of some 2,500,000 acres were irrigated, while the mileage of the main canals, branches and distributaries of the eight productive major works (one of the major works being protective) was 5,789, of which 990 miles were for irrigation and navigation combined. The report contains statistical exhibits and descriptive matter for the various irrigation systems. The report is not confined to capital and revenue accounts, but includes, also, statistics of lengths of canals, areas irrigated, rainfall, duty of water, flood heights and navigation. The irrigation works in question include the notable Godavari and Kistna delta systems and the Periyar project.

REPORT ON RAILWAY TIES.—Report of the Committee on Ties; Bulletin No. 43 of the American Railway Engineering and Maintenance of Way Association; Secy., E. H. Fritch, Monadnock Block, Chicago. Paper; 6 × 9 ins.; pp. 34; illustrated.

This report was prepared for the annual meeting in March, 1903, and an abstract was given in our issue of March 26. Owing to lack of time it did not come up for consideration, and is now issued in pamphlet form, with some revisions and additions, and written discussions. The report deals mainly with treated ties, their use, and their records. The use of dated nails to indicate the life of ties is urged, but in the discussion some members prefer a system of notching, although the general opinion is strongly in favor of the nails as being more reliable and more definite. Several tables give the tie renewal records for individual railways in the United States, Australia and India.

INTERNATIONAL MINING DIRECTORY.—A. R. Dunbar, Editor. Denver and San Francisco: Western Mining Directory Co. Cloth; 8 × 11 ins.; pp. 516. $10.

This directory gives the name and location of the principal mines and metallurgical plants in Africa, Australasia, Canada, India, Japan, Korea, Mexico, South America, Central America and the Western United States. The ownership, manager's name, kind of ore, character of equipment, and number of men employed are given for each of the mines and plants enumerated, thus making a very valuable compendium for use by manufacturers of machinery and others desiring to reach consumers of mine and mill supplies and machines.

ONTARIO LAND SURVEYORS.—Proceedings of the Annual Meetings at Toronto, Feb. 24 to 26, 1903. Toronto, Ont.: The Association. Paper; 6 × 9 ins.; pp. 164; illustrated, 50 cts.

This pamphlet contains a number of brief committee reports, and a few papers on country roads, surveys and the like. It appears from one of the papers that the provincial government of Ontario has appropriated $1,000,000 towards the construction of country roads.

Publications Received.

RAILROAD CURVES AND EARTHWORK.—By C. Frank Allen, M. Am. Soc. C. E., Professor of Railroad Engineering in the Massachusetts Institute of Technology; Third Edition. New York: Spon & Chamberlain. London: E. & F. N. Spon. Leather; 4 × 7 ins.; pp. 198; tables and diagrams. $2; or, if bound, with tables (look below), $3.

FIELD AND OFFICE TABLES.—Specially Applicable to Railways. Author, publisher, style and size as above; pp. 293. $2; or, if bound, with Railroad Curves, $3.

THE MECHANICAL ENGINEER'S POCKET-BOOK.—By the late D. Kinnear Clarke, M. Inst. C. E.; Fifth Edition; Revised Throughout and Enlarged by H. H. P. Powles, M. Inst. M. E., Assoc. M. Inst. C. E. New York: D. Van Nostrand Co. Leather; 4 × 6 ins.; pp. 692; tables and figures in the text. $3.

THE PRACTICAL TESTING OF DYNAMOS AND MOTORS.—By Charles F. Smith, Assoc. M. Inst. C. E., Assoc. M. Inst. E. E. Manchester, England: The Scientific Publishing Co. Cloth; 6 × 9 ins; pp. 231; 82 figures in the text. $2.

COMPRESSED AIR.—A Treatise on the Theory and Practice of Pneumatic Power Transmission. By William Charles Popplewell, Assoc. M. Inst. C. E. Manchester, England: The Scientific Publishing Co. Cloth; 6 × 9 ins.; pp. 284; 118 figures in the text. $3.

WOOD.—A Manual of the Natural History and Industrial Applications of the Timbers of Commerce. By G. S. Boulger, Professor of Botany and Lecturer on Forestry in the City of London College. London: Edward Arnold. New York: Longmans, Green & Co. Cloth; 5 × 8 ins.; pp. 369; 4 plates and 66 figures in the text. $2.60 net.

CARE OF THE HOUSE.—A Volume of Suggestions to Householders, Housekeepers, Landlords, Tenants, Trustees and Others for the Economical and Efficient Care of Dwelling Houses. By T. M. Clark. Cloth; 5 × 7½ ins.; pp. 284. $1.50 net.

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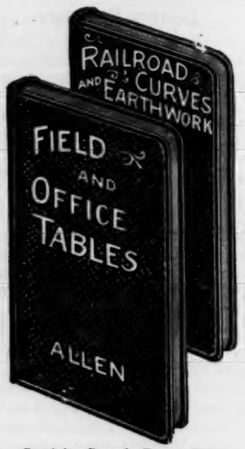

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